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PHYSICAL MEDICINE AND THE UPSURGE OF MEDICAL LITIGATION

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SINCE the conclusion of the second world war members of the public have increasingly invoked the legal right to seek compensation by way of monetary damages for wrongs they believe they have suffered through the negligent acts or omissions of medical practitioners. Many rights hitherto enjoyed by citizens have been invaded, modified, or left in legal doubt as a result of legislation and statutory regulations. Employers of labour, public authorities, and voluntary organizations have had to resort to their legal advisers to interpret for them the changing obligations imposed by Parliament.

The Legal Aid and Advice Act, 1949, has increased the volume of litigation passing through the courts, and the political supporters of that measure maintain that its appearance on the Statute Book is justified by the results accruing from the availability of legal aid. Medical practitioners, nurses, medical auxiliaries and technicians are aware of the increased danger of litigation arising from some act or omission in the conduct of their work that is alleged to have damaged a patient's physical or mental well-being. Such a risk is inseparable from any treatment with a potentiality for damaging a patient and accompanied by known hazards. Into this category fall most forms of treatment prescribed and carried out in departments of physical medicine. This paper reviews the legal problems and hazards of physical medicine and their impact on those who practise it.

To limit the scope of discussion I propose to examine the appropriate problems as they arise in hospitals maintained under the National Health Service Acts. To appreciate accurately the legal status of hospitals it is necessary to review how it was acquired.

Robert Forbes

Hospitals and the Law

At the beginning of the present century a notable case, referred to as Hillyer *v.* St. Bartholomew's Hospital, was heard in our courts. In that case the plaintiff sought to recover monetary compensation from the governing body of St. Bartholomew's Hospital for burns he sustained during a medical examination under a general anaesthetic. The judgment made it clear that the law did not countenance that any responsibility attached to the governing body of the hospital for the alleged acts or omissions of its medical staff. In fact, it declared that the only obligation borne by the governors in this connexion was that of satisfying themselves that those appointed to the medical staff were fit and proper persons to carry out the duties assigned or assumed. This was doubtless intended to mean that they must be legally qualified and suitably experienced for their various offices. For many years the judgment in that case held sway until 1942, when a differing view was adopted by the Courts. The case producing this shift of opinion was that of Gold *v.* Essex County Council (1942) 2 K.B. 293. The facts are as follows:

A girl was referred by a dermatologist for the treatment of warts on her face by grenz rays. The first treatment was given without mishap, but the second was followed by signs of burning due to the failure of the radiotherapist to apply lead-lined lint to protect the normal tissues of the face. An action was raised against the Essex County Council, who were the employers of the radiotherapist and the owners of the hospital. In the court of first instance Mr. Justice Tucker held that the radiotherapist had been negligent, but he was driven by the leading case of Hillyer *v.* St. Bartholomew's Hospital to give judgment in favour of the County Council. On appeal Mr. Justice Tucker's judgment was reversed by three judges, who rejected the interpretation usually placed on the Hillyer case—namely, that public authorities did not themselves undertake treatment and nursing, and that their liability extended only to the provision of a competent staff and suitable premises for them to meet in to conduct their work. It was held and expressed in the judgment that:

(1) A nurse, a radiographer, or other medical auxiliary or technician is the servant of the hospital for the performance of all duties, including those for which technical skill is necessary.
(2) A hospital, whether a voluntary or a public institution, undertakes maintenance, treatment, and nursing, which it provides through the hands and minds of its servants, such as medical practitioners, nurses, medical auxiliaries, and others in a contributing capacity.
(3) A hospital is liable for the negligent acts or omissions of its servants in the course of their duties when these cause damage to patients.

This judgment blew a large hole in the Hillyer case. Incidentally it should be noted that the obligation of the hospital was held to be the same whether the patient was treated gratuitously or not. It distinguished between a visiting consultant as in the Hillyer case and a member of the

whole-time salaried staff on the ground that a visiting consultant was engaged on "a contract *for services*", whereas the salaried employee was engaged on "a contract *of service*". It concluded that a visiting consultant was not the servant of the hospital like a whole-time radiotherapist or nurse, and consequently that the hospital was not liable for his negligent acts or omissions.

This new line of judge-made law was readily seized by solicitors advising plaintiffs, with the result that many hospital authorities have since had to pay damages and costs awarded against them or have had to settle out of court actions based on the alleged acts or omissions of whole-time employees. In a later case involving a house-surgeon and a visiting consultant (Collins *v.* Herts County Council) the hospital as employer was held liable in damages for the negligent act of the house-surgeon, while the surgeon was held liable for his own negligence. In that case a patient received at the hands of the consultant, preparatory to an operation for excision of the jaw because of malignant disease, a dose of cocaine that proved fatal. The house-surgeon had had the local anaesthetic prepared on the instructions of her chief, which instructions she had misheard or misinterpreted, and she also failed to follow certain rules of the hospital relating to this matter.

The Cassidy Case

Without subsequently pursuing the matter in detail it might be of advantage to outline the "Cassidy case".

A Mr. M. Cassidy appealed from the decision of Mr. Justice Streatfeild at the Liverpool Assizes when his action against the Ministry of Health for negligent treatment was dismissed. Cassidy alleged that he had been submitted to negligent treatment during or after an operation on his left hand by a Dr. Fahrni. The operation was performed at a hospital that had been transferred to the Ministry on the passing of the National Health Service Act, 1948. The Ministry denied negligence and responsibility for the professional skill of Dr. Fahrni, whom they brought in as a third party. In the judgment given by Lord Justice Somervell in the Court of Appeal it was disclosed historically that Cassidy suffered in 1948 from a contracture of the third and fourth fingers of his left hand, then diagnosed as Dupuytren's contracture. An operation was recommended by Dr. Fahrni. It was necessary after the operation to keep the hand in a splint for eleven to fourteen days. A nurse bandaged the arm and a surgeon satisfied himself that the splint was not overtight. The patient complained repeatedly of pain, for which the house-surgeon ordered sedatives. Towards the end of the fourteen-day period, when the bandage was removed, it was discovered that not two but four fingers were affected. The two fingers on which the operation had been performed were almost stiff, but in addition so were the fingers on either side. In his Lordship's opinion the result appeared to raise a *res ipsa loquitur**, and the jury would have been entitled to find on the facts

* The thing speaks [for] itself.

stated. It was held that the hand had been bandaged too tightly and not enough heed had been paid to Cassidy's complaint of pain; and, additionally, that the splint should have been loosened, or should have been inspected before the elapse of fourteen days.

Those who are interested in the evolution of the law relating to medical litigation will find a review of the decided cases in the judgment of the three distinguished judges who heard the case on appeal. This did not, however, point to one individual as being responsible for what had occurred, and therefore it left open the decision whether responsibility might attach to the operating surgeon, the house-surgeon, or the nurse, or to more than one of these. The Court held that the hospital authority was responsible for the whole-time house-surgeon and the whole-time nurse, and the three members of the judiciary decided also that responsibility for the acts of the operating surgeon devolved upon the hospital. Lord Justice Denning made a significant observation that may be of help in an appraisement of the problem. He said: "I take it to be clear law as well as good sense that, where a person himself is under a duty to use care, he cannot get rid of his responsibility by delegating the performance of it to someone else, no matter whether the delegation be to a servant under a contract of service or to an independent contractor under a contract for services." He went on to point out that a patient had no voice in the selection of the persons by whom he was treated. If the consultant and nurses concerned did not use proper care and skill the hospital authorities must answer for their omission. The appeal was accordingly allowed, and the case sent back to the lower court for assessment of damages against the Ministry.

The Law and the Physical Medicine Department

A physical medicine specialist who is a member of a hospital staff is obliged to bring to the conduct of his clinical work a reasonable degree of care and skill, in default of which, if he damages a patient by such failure, he may be sued and mulcted in damages.

A hospital medical officer may, however, prescribe a form of treatment to be administered in the Department of Physical Medicine by a qualified physiotherapist. If that physiotherapist damages the patient in carrying out or by failing to carry out the treatment prescribed, it is highly probable that she may be sued for the damage she has caused. The plaintiff may, however, at the same time sue the employing authority and that authority may be saddled with the responsibility of paying the damages. Should there be any question as to the propriety of the prescription or the suitability of the treatment prescribed, the hospital doctor responsible might then be sued or he might be brought in as a third party by the hospital authority.

It might be thought that, in the light of the observations made in the Cassidy case, the consultant also should be entitled to look to his employing authority for indemnification and protection in actions of that kind.

Unfortunately, the observations to which so much attention has been paid in the Cassidy case were *obiter dicta**. There are eminent lawyers who would dispute the validity of the observations by Lord Justice Denning and his brother judges. In hospital practice, therefore, at the present time we find that it is not customary for the employing authority to accept responsibility for the clinical acts or omissions of consultants from the rank of registrar and upwards. Below the level of registrar responsibility has hitherto been commonly accepted, though often a contribution is sought and is made towards the damages and costs awarded or agreed in settlement out of court by the defence organizations of which the practitioners may be members. (The judgment given in a recent case may, however, modify this situation in future.)

A consultant in charge of a physical medicine department must of necessity recognize that, in addition to clinical responsibilities, he has a supervisory responsibility to ensure that the department is adequately and properly run; that his subordinates conduct their work carefully and skilfully; and that the treatment prescribed is accurately followed and is suitably adjusted to the physique of the patient—that is to say, that it is not harmful to the patient.

In her own sphere of activity the subordinate physiotherapist must act with care and skill and must follow the direction of her chief. Prescriptions should be given, whenever practicable, in a written form, if only to protect both consultant and subordinate against a possible future claim that what was done was not in accordance with what was ordered to be done. Oral instructions are apt to be misunderstood and misapplied. Many examples of this could be cited.

The question is often raised as to what is meant by "supervision". Is it intended that supervision should be general or particular to each case? Naturally circumstances alter procedures. Where a consultant is satisfied with the work and reliability of his subordinates he may be content to have from time to time a spot check on the standard of their work. If he is not satisfied he must keep a close supervision until he is satisfied that he can relax that supervision. He must also remember that he has an overriding responsibility for the administration and safe working of the department. He cannot assume that a safe system, once evolved, will be scrupulously followed on all future occasions. He may be assailed for something a subordinate has done and may have to defend himself in court; it would therefore behove him to have a good defence which when presented would relieve him of liability for what had happened.

A relevant case that has been heard in our courts may be cited on the need for physiotherapists to give adequate warning of any possible danger that may arise during treatment.

* Judge's expressions of opinion, therefore without binding authority.

A plaintiff secured damages amounting to £3,263 on satisfying the Court that he had been negligently treated for a fibrositic condition of his left heel. The defendant physiotherapist had treated the patient with diathermy, and the plaintiff maintained that he had lost his left leg below the knee owing to a failure on the part of the physiotherapist to warn him to give an indication if he experienced any painful sensation. The physiotherapist was alleged to have urged the patient to continue with the treatment as there would be but a few more minutes before it was all over. The defendant denied this, and said that the patient admitted on the following day that he thought he ought to "stick out the treatment".

In physiotherapy the co-operation of the patient is vital. The instrument used is often potentially dangerous, and in the case under review caused a burn from over-exposure to diathermy. The pain that the plaintiff may have suffered should have acted as a warning signal to him, and if reported to the defendant could have indicated the need for interrupting the treatment.

In his judgment in the above case the judge maintained that the warning given to patients in these circumstances should be couched in terms making it abundantly clear that the patient would be the first to recognize the danger. He thought that in this case the warning given to the patient had been inadequate, and on that ground the plaintiff, he held, was entitled to recover damages.

Finally, if any consultant directs or prescribes a form of treatment that a subordinate is not competent to undertake but which he in fact does undertake, then the superior may expect legal trouble if something goes wrong in the administration of the treatment, and may well be held responsible.

Steps to Reduce the Risk of Litigation

In an effort to reduce the risk of resort to the law by dissatisfied or disappointed patients attention should be paid to the following points. Patients should be provided with an explanation of their illness (i.e. diagnosis), and certainly of the treatment proposed to be administered for the alleviation of the condition. To administer any form of treatment to a patient without his implied oral or written consent constitutes an assault on the person. Some forms of treatment are largely palliative and not intentionally curative. Some must be continued for a long time to secure a favourable result. The patient's interests must be considered—for example, the inconvenience caused by frequent attendance at hospital, the protracted time over which attendance may be necessary, the general upset in family life and arrangements, or the immobilization of a limb during treatment. It is believed that some litigation would be avoided if the hospital staff were less cryptic or mysterious with patients. A frank explanation and an acknowledgment of the limitations of treatment would assist

in this respect. When any form of treatment carries a particular risk, the fact of the existence of that risk should not be withheld from the patient; it can be suitably explained, and should be so explained. The mental and physical co-operation of the patient, so essential to the success of some forms of therapy, should be evoked, and when it is forthcoming a liaison should be effected that will go a long way towards reducing the misunderstandings and misrepresentations that create animosity and ultimately lead to litigation.

CONFERENCE ON THE TREATMENT OF CEREBRAL PALSY

THE British Council for the Welfare of Spastics will hold a Conference on the Treatment of Cerebral Palsy from September 28 to 30, 1954, in the Great Hall of the British Medical Association. The Conference, which will be presided over by Professor N. B. Capon, of Liverpool University, is open to members of the medical profession, physiotherapists, occupational and speech therapists, and the staffs of special schools and classes for cerebral palsied children. Applications for tickets should be made to the Secretary of the Council at 13 Suffolk Street, Haymarket, London, S.W.1.

PENETRATION OF ADRENALINE THROUGH THE SKIN

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ADRENALINE cream has been advocated for the treatment of "chronic rheumatism", fibrositis, osteoarthritis, and rheumatoid arthritis (Moss, 1949, 1950; Howell, 1950). The reports mentioned were based on the inunction of a commercial preparation containing 1 in 5,000 adrenaline hydrochloride made up in a vanishing-cream base. The rationale for the use of adrenaline cream is founded on the assumption that the adrenaline penetrates through the skin and subcutaneous tissues to the affected muscle, thereby causing dilatation of the blood vessels. This is believed to help in "eliminating the waste products of stasis, bringing about the resolution of the pathological changes in the tissues" (Moss, 1950).

The present investigation was carried out with the object of determining whether adrenaline from adrenaline cream can penetrate the skin in sufficient concentration to have a physiological effect.

Methods

Subjects used for the experiment were patients at the Royal Air Force Medical Rehabilitation Unit, Collaton Cross, all of whom were between 18 and 38 years old and were undergoing rehabilitation after traumatic injuries; none was suffering from arthritis or other rheumatic conditions. Adrenaline was applied to the skin by four methods.

1. Inunction.—Adrenaline cream was applied with a finger enclosed in a surgical rubber finger-stall, an average "finger-full" being used in each case. The cream was rubbed in for five minutes. The sites selected were either the back, the patient leaning forward with the head resting on the arms so that the scapulae were drawn forward, or the flexor surfaces of the forearms. Comparisons were always made laterally (left against right side) and never vertically, at anatomically comparable sites.

2. Ionization.—Adrenaline cream was applied to the skin under the active (positive) electrode of a constant-current generator. The electrode was 1 inch (2·54 cm.) in diameter and was applied to the flexor surface of the forearm. A current of 3 milliamperes passing for three minutes was used. The indifferent electrode was 2 inches (5 cm.) square and was applied to the extensor surface of the forearm.

3. Vaccination.—Adrenaline cream was applied to the back and a series of skin punctures made through the cream according to the technique described for the "multiple-pressure vaccination method" (*Mthly Bull. Min. Hlth*, 1947, **6**, 164).

4. Intradermal Injection.—To study the effect of known concentrations

of adrenaline on the skin vessels, various concentrations of freshly made up adrenaline hydrochloride in 0·9% saline were injected intradermally by means of a tuberculin syringe and intradermal needle. In all cases 0·1 ml. of solution was injected. The effects were assessed ten minutes after injection. In all tests an independent observer was called in and the effect was compared with that of an injection of 0·9% saline. All concentrations were tried in all subjects. The injections were made at similar times and in the same (centrally heated) room, with identical skin preparation.

Adrenaline injected into the skin produces an area of blanching due to constriction of the skin vessels (Lewis, 1927). Positive results were recorded for those injections which were judged to show blanching when compared with a control injection of saline introduced into a comparable anatomical site at the same time.

Results

1. Inunction.—In a series of 6 subjects commercial adrenaline cream when applied by inunction produced no physiological effect as measured by blanching. As the commercial product, advertised as being of a concentration of 1 in 5,000, produced no blanching, a 1 in 100 adrenaline cream was made up in a vanishing-cream base. In a similar series of subjects no blanching was produced with this cream either. A 1 in 10 adrenaline cream in a vanishing-cream base was then made up. In all of 10 subjects there was evidence of physiological activity when the cream was applied by inunction. Areas of blanching which were small, circular, and discrete were produced, each area being approximately $\frac{1}{8}$ inch (3 mm.) in diameter.

2. Ionization.—A 1 in 5,000 commercial adrenaline cream applied by ionization produced an area of blanching under the positive electrode in each of 6 subjects. When the time of application was greatly reduced the blanching appeared in discrete circular areas which increased in size as the time of application was extended until an area of blanching corresponding to the area of the electrode was produced.

3. Vaccination.—Vaccination through commercial adrenaline cream produced areas of blanching in relation to the points of pressure in each of 6 subjects.

4. Intradermal Injection.—The preceding experiments showed that commercial adrenaline cream does not produce blanching when applied by inunction. However, when there is a high concentration of adrenaline in the cream, or the continuity of the skin is broken, or ionization is used, then adrenaline cream will produce blanching.

In order to estimate the minimum concentration of adrenaline which will cause blanching of the skin 9 subjects were given intradermal injections of 0·1 ml. of adrenaline hydrochloride solution made up in concentrations of 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, 10^{-8}, 10^{-9}, and 10^{-10} in 0·9 ml. of saline. The results showed a variability of response, but blanching in both arms

occurred in all 9 subjects when concentrations of 10^{-6} or stronger were used. The full results are shown in the Table.

TABLE SHOWING RESULTS OF INTRADERMAL INJECTION OF VARIOUS STRENGTHS OF ADRENALINE HYDROCHLORIDE

Subject No.	Arm	Concentration						
		10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}	10^{-9}	10^{-10}
1	R.	+	+	+	+	−	−	−
	L.	+	+	+	+	−	−	−
2	R.	+	+	+	+	+	+	+
	L.	+	+	+	−	+	+	+
3	R.	+	+	+	+	+	+	−
	L.	+	+	+	+	−	−	−
4	R.	+	+	+	+	+	+	−
	L.	+	+	+	+	−	−	−
5	R.	+	+	+	+	+	+	+
	L.	+	+	+	+	+	−	+
6	R.	+	+	+	+	+	−	−
	L.	+	+	+	+	+	+	−
7	R.	+	+	+	+	+	+	−
	L.	+	+	+	+	+	−	−
8	R.	+	+	+	+	+	−	−
	L.	+	+	+	+	+	+	−
9	R.	+	+	+	+	+	−	−
	L.	+	+	+	+	+	−	−

+ = Blanching as compared with control intradermal injection.
− = No blanching as compared with control intradermal injection.

Discussion

This investigation has demonstrated that commercial adrenaline cream will produce blanching of the skin only when it is "driven" in by ionization or by "vaccination". This finding is in agreement with the work of Peck, Finckler, Mayer, and Michelfelder (1950), who showed that "pyribenzamine" (tripelennamine) applied by inunction could be demonstrated later in the urine only when the skin to which it was applied had been damaged by dermatitis.

When the ionizing current was applied for a short time or when 1 in 10 adrenaline cream was applied by inunction the blanching appeared in small discrete areas. These areas occurred in greatest numbers where hair grew thickest. These findings agree with those of Shelley and Melton (1949), who, working with histamine, showed that the hair follicles and the sebaceous glands appeared to form the pathway to the subcutaneous

tissues, and who concluded that the passage of substances through the intact skin depends on the concentration of the active substance on the skin and the characteristics of the skin in the area of application. These characteristics will vary according to the patient and the disease to be treated, while the concentration of the active substance on the skin will depend on the strength of cream used.

Commercial adrenaline cream is made up in a concentration of 1 in 5,000 or 1 in 1,000. From this investigation it is clear that when adrenaline in such concentration is applied by inunction it does not produce a visible effect on the skin vessels. Adrenaline introduced into the skin by intradermal injection, however, evoked a constant response of blanching at a concentration of 1 in 1,000,000 (10^{-6}), and in some subjects at a concentration of 1 in 10,000,000,000 (10^{-10}).

This investigation indicates that 1 in 5,000 commercial adrenaline cream is incapable of producing an intradermal concentration of adrenaline equivalent to a 10^{-6} adrenaline hydrochloride solution, and is probably incapable of producing the equivalent of a 10^{-10} concentration of solution.

It is concluded that if adrenaline from a commercial 1 in 5,000 preparation or from 1 in 100 adrenaline cream passes into the skin, then it does so in a concentration below 1 in 1,000,000.

Summary

1. An investigation was carried out to determine whether adrenaline in the form of adrenaline cream can penetrate the skin in a concentration sufficient to have a physiological effect.

2. Adrenaline cream in concentrations of 1 in 5,000 and 1 in 100 produced no blanching of the skin when applied by inunction, but did so when applied by ionization or "vaccination".

3. It was demonstrated that intradermal injection of adrenaline hydrochloride in a concentration of 10^{-6}, and in some subjects of 10^{-10}, will produce visible blanching.

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HEATING OF FATTY TISSUES IN A SHORT-WAVE FIELD

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IT is known that fatty tissues tend to become greatly heated in a short-wave condenser field (Schliephake, 1938), and burns have been reported to occur in the subcutaneous tissues when the overlying skin appeared to be undamaged. Schmidt (1935) has observed severe coagulation of these tissues with little change in the skin. Again, Bierman (1942) has demonstrated, by means of graphs of the temperatures of skin, subcutaneous tissues, and muscle after exposure to a short-wave field, that the rate of heating of fatty subcutaneous tissues is greater than that of either skin or muscle. It was thought by Clayton (1949) that this phenomenon was due to intense heating of the fat itself which in its turn was attributable to the great resistance of fat, the heating being the result of dielectric straining in the condensers in the fat. The fat was believed to become extremely hot in a short-wave field and to dissipate its heat to the blood vessels. Tissue necrosis was explained by assuming that the blood supply was not sufficient to carry away the heat energy rapidly enough.

While investigating the effects of various frequencies on mineral oil and saline exposed to condenser fields in two concentric cylindrical vessels Osborne and Holmquest (1944) noted that oil invariably heated up more readily than saline. Even so the poor heating qualities of mineral oil are made use of in apparatus operating at high frequency. It was felt that this apparent contradiction was worthy of investigation. A double set of experiments was therefore carried out to determine which constituent of anatomical fat was responsible for excessive heating—the fat itself, the electrolytes, or the network of blood vessels.

First Series of Experiments

A square perspex container was constructed with sides 3 inches long and $1\frac{1}{2}$ inches deep. This was divided into two equal compartments by a perspex partition one-sixteenth of an inch thick. One compartment was filled with a known mass of purified human fat prepared as follows:

Fatty tissue was obtained from cadavers and was then minced and shaken up with ether. When this mixture was left to stand the water separated out at the bottom. The mixture was then heated up in a water bath under reduced pressure until the ether was completely evaporated off, leaving the purified water-free fat. At room temperature this takes the form of a yellow solid closely resembling butter.

The other compartment was filled with a measured quantity of sodium chloride solution (0·85 g. per 100 ml.). The initial temperatures of the two

substances were noted, and the phantom was exposed to a short-wave field with the two compartments in series as shown in Fig. 1A. The electrodes used were 4 cm. in diameter and the spacing was $\frac{1}{4}$ inch (0·637 cm.). After a specified time the final temperatures of the substances were taken and the power dissipation in watts in each compartment was calculated. The formula employed was as follows:

$$P = JMs \frac{\theta_2 - \theta_1}{t}$$

where P = power, J = Joules equivalent, M = mass, s = specific heat, θ_1 = initial temperature, θ_2 = final temperature, and t = time in seconds. The specific heat of the fat was found by method of mixture to be 0·59. The experiments were repeated a number of times, the average power dissipation in each compartment being obtained.

A small quantity (0·43 g.) of distilled water was introduced into the purified fat and the experiments were repeated. The phantom was then placed in the short-wave field so that the compartments were in parallel as in Fig. 1B and the experiments again repeated, the average dissipation of power in each compartment being calculated.

It may be seen from the Table that with the compartments in series (i.e. when there would be little field distortion) the power dissipated by the fat was less than by the saline. The temperature of the fat was, however, higher than that of the saline. This is probably because of the specific heat of the fat as compared with the saline, and also because the current in both compartments is restricted by the impedance of the fat.

When a small quantity of water was introduced into the fat the mixture of pure fat and water dissipated nearly twice the power of the saline. It was noted that the water boiled in the fat shortly after the short-wave current was applied. The temperature of the mixture when boiling occurred was

TABLE SHOWING THE EFFECTS OF A SHORT-WAVE FIELD ON FAT AND SALINE

Substance	Compartments in Series (water-free)		Compartments in Series (water added)		Compartments in Parallel (water-free)	
	Rise in Degrees Centigrade	Watts	Rise in Degrees Centigrade	Watts	Rise in Degrees Centigrade	Watts
Fat	2·0	4·0	7·7	15·3	1·66	3·3
Saline	1·67	5·6	2·49	8·3	2·5	8·4
Result	Fat greater than saline	Saline greater than fat	Fat greater than saline	Fat greater than saline	Saline greater than fat	Saline greater than fat

less than 40° C. This confirms the finding of Kowarschik (1942), who used a paraffin–water emulsion.

When the phantom was turned so that the compartments were in parallel the saline dissipated nearly three times the power of the fat. In this case the field concentrates in the saline, as its impedance is small compared with that of fat. This accords with the results of Cumberbatch (1939).

In a further experiment the container was filled with anatomical fat obtained from fresh cadavers in one compartment and purified fat in the other, and exposed to a condenser field, first with the substances in series and then in parallel. In both cases the purified fat showed little evidence of heating, but shortly after exposure to the field the channels between the lobes of anatomical fat could be seen to steam and finally boil, with resulting "cooking" of the tissues surrounding the fat lobules. The rise in temperature of the anatomical fat was 7·67 times that of the purified fat with the substances in series, whereas when they were in parallel it was 23·1 times as high owing to the field distortion. The heating of the anatomical fat was greater than that of the pure fat when the two were in parallel. This is because the resistance of anatomical fatty tissue is much less than that of pure fat, and therefore the current flow is much greater through the former. When the two compartments are in series the field in each is approximately the same, and the greater heating of the fatty tissues is probably due to concentration of the field in the conducting channels within it. Although the field densities are substantially the same, it is probable that a large proportion of the current in the pure fat is wattless.

When the pure fat in the last experiment was replaced by saline, with the saline and the anatomical fat in parallel, the rise in temperature of the saline was found to be 1·4 times that of the fat, indicating that the major part of the current was passing through the saline. In this experiment no boiling or steaming was noted in the spaces between the lobules of the fatty tissues.

Discussion

It appears that there are two important factors in the heating of tissue fat in a short-wave field. First, in fields of comparable density pure fat attains a slightly higher temperature than saline, although the power dissipation is less. This is probably because pure fat requires only 0·59 Calorie per gramme of heat to raise it through 1° C. Secondly, should this fat be shunted by a pathway of smaller resistance—as indeed it always is *in vivo* by tissue fluids, blood vessels, etc.—then the dissipation of power and the rise of temperature are very much greater than with saline.

It seems probable that this shunting of the current is the reason for the

PLATE X

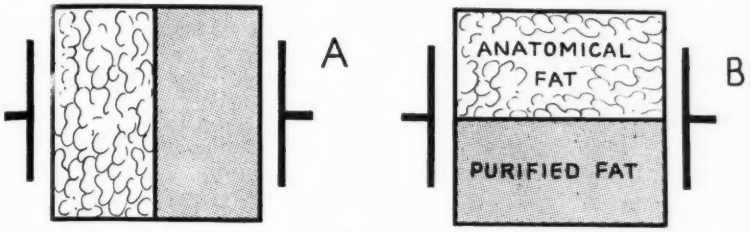

FIG. 1

A. Compartments in series.

B. Compartments in parallel.

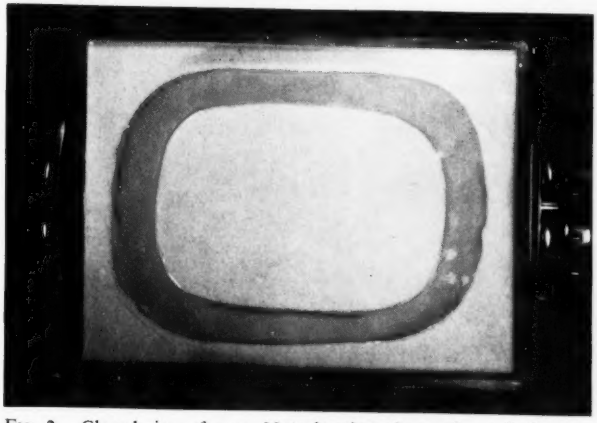

FIG. 2.—Closed ring of wax. Note heating along edges of phantom at top and bottom after 2 minutes.

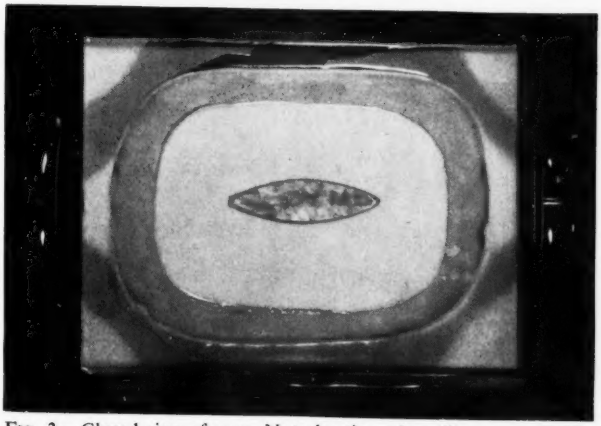

FIG. 3.—Closed ring of wax. Note heating of medium around ring. Wax has melted at side of phantom in upper part of figure. No heating at ends of pointer after 4 minutes.

B.O.S. face p. 50]

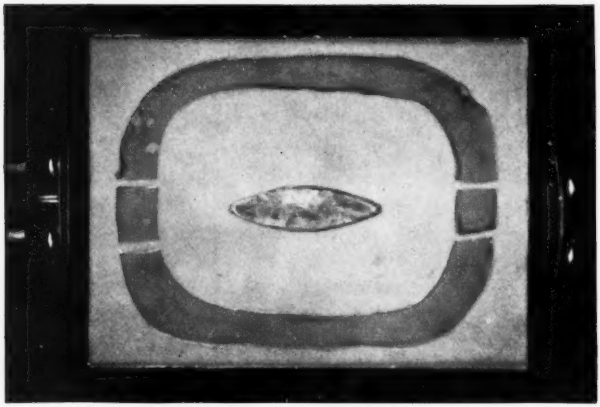

FIG. 4.—Split ring of wax. No field has yet been passed.

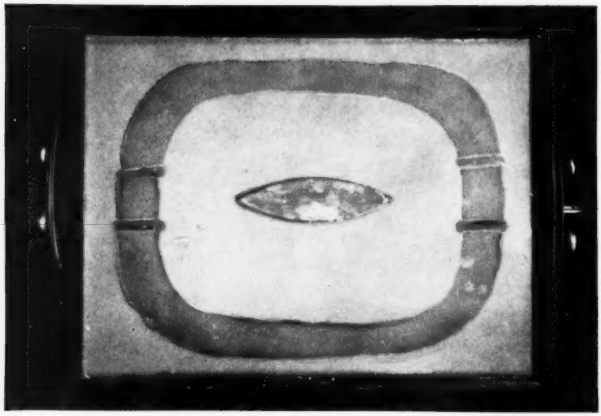

FIG. 5.—Note immediate heating of channels in wax after 10 seconds' heating.

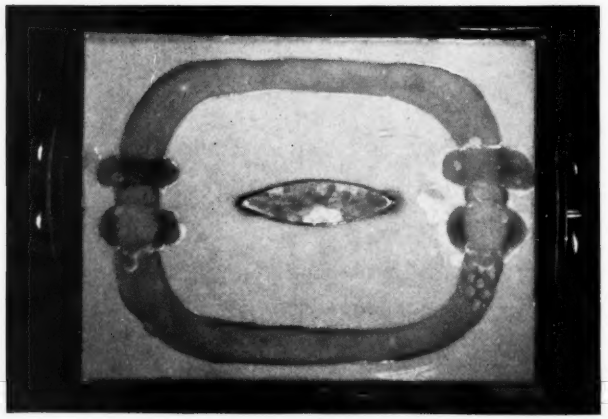

FIG. 6.—Note melting of wax and effects of boiling of medium after 3 minutes' heating; also heating at ends of pointer.

great dissipation of heat which Schliephake (1938) has shown to occur in human fatty tissue.

Second Series of Experiments

In the body all muscle is surrounded by a ring of fatty tissue, and therefore any field in the muscle must traverse the fatty tissue. On this assumption experiments were carried out using a ring of paraffin wax to represent the surrounding fat. Fig. 2 shows a complete ring of wax embedded in a phantom with the double silver–mercury iodide used as a heat indicator. When this phantom was placed in a short-wave field the heating appeared first along the sides of the wax ring. The main heating pattern was seen to pass around the closed ring of wax, heating the wax only at the points of high concentration of the field in the medium. That there was no appreciable heating inside the ring is demonstrated by the lack of concentration of heat at the ends of the pointed conductor placed inside the ring (Fig. 3). Thus in a closed ring the main heating is observed on the outside of the ring, there being a very much reduced field inside. This is to be expected on purely theoretical considerations.

Fig. 4 shows the wax ring broken at the ends and replaced in the phantom in such a way that there are two narrow channels of medium at each end connecting the inside medium with that outside. When a short-wave current is applied to this incomplete ring the channels heat up immediately (Fig. 5); within ten seconds the medium in the channels boils and the wax melts along their borders. This process rapidly spreads deeper into the wax. The presence of a field in the centre of the ring is shown by heating at the ends of the pointed conductor (Fig. 6).

Discussion

If the channels made in the wax ring are regarded as the conducting components of body fat, it is probable that this experiment provides the explanation for the great heating of fatty tissue in the body. The short-wave field concentrates on these conductors, shunting the capacitance of the fat. This results in a high field concentration in the vessels and conducting channels, which in turn causes great heat dissipation in fatty tissues. When the field reaches the muscular structures, which are better conductors, the field probably spreads out again, with consequent lower field concentration and less local heating.

This theory adds weight to the known fact that a poor blood supply increases the danger of burns. A poor blood supply implies fewer patent fluid channels and results in higher field concentration and increased heat production in those remaining open. Further, the blood flow is less, with consequent slower dissipation of the increased heat that has been produced, and burning and necrosis follow.

Medico-legally this theory of the heating of fat is interesting, since burns which have been difficult to explain have been produced by short-wave diathermy.

Summary

(1) It has been shown by experiment that pure human fat does not dissipate as much power as does normal saline in a short-wave field. Human fat containing a small quantity of moisture dissipates considerably more power. The reason for the occurrence of burns in fatty tissues is probably not the excess heating of the fat alone. Pure fat with a parallel shunt of saline does not heat greatly in a short-wave field.

(2) A complete ring of wax does not heat up in a high-frequency field, but if channels of conducting medium are made in the wax great heating occurs. This suggests that it is the presence of blood vessels and tissue spaces shunting the field which is responsible for more heat dissipation in fatty tissue than in muscle.

Acknowledgments

I would like to express my thanks to Dr. A. H. T. Robb-Smith and Dr. W. Taylor for their help in obtaining and purifying the fat; also to Sister A. M. Hutcheson for her assistance with some of the experiments, and Miss M. McLarty for drawing the diagrams. My thanks are also due to Dr. D. G. Wyatt for all his help.

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THE AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

ANNUAL SESSION, 1953

By GORDON M. MARTIN

Section of Physical Medicine and Rehabilitation, Mayo Clinic and Mayo Foundation, Rochester, Minnesota

MORE than 900 persons interested in physical medicine and rehabilitation registered for the 31st Annual Scientific and Clinical Session of the American Congress of Physical Medicine and Rehabilitation, held in Chicago from August 31 to September 4, 1953. Although late summer heat records were being made daily, with afternoon temperatures of 99° to 102°, the attendance was excellent at lectures and discussions of the scientific session. In addition to the scientific sessions the programme included an instruction seminar, business meetings, the presidential address, the annual dinner, the Coulter Memorial Lecture, and scientific and technical exhibitions.

Meeting of the American Society of Physical Medicine and Rehabilitation

The American Society of Physical Medicine and Rehabilitation, whose membership is made up of diplomates of the American Board of Physical Medicine and Rehabilitation, sponsored the programme for the first day of the meeting. The morning session was devoted to an educational conference, during which the chairman of the Committee on Education of the Congress, Dr. Earl C. Elkins, discussed problems in education related to physical medicine and rehabilitation that had come to the attention of this committee during the past year. Dr. E. H. Leveroos, an associate secretary of the Council on Medical Education and Hospitals of the American Medical Association, explained methods of evaluation and approval of residencies for the training of physicians at the postgraduate level. Dr. Clay d'A. Gerken, associate professor of psychology at the University of Iowa, discussed problems encountered in the evaluation of professional competence of personnel in physical medicine and rehabilitation. Dr. Gerken has assisted the American Registry Board for Physical Therapists as well as the American Board of Physical Medicine and Rehabilitation for a number of years in examining therapists and physicians at the completion of approved training programmes. A scientific session was held in the afternoon under the chairmanship of Dr. Donald L. Rose, of the University of Kansas. Three scientific papers were presented by members of the American Society of Physical Medicine and

Rehabilitation, and these were followed by a panel discussion on "New Concepts in Treatment of Rheumatic Diseases", with Dr. Walter M. Solomon as the moderator.

General Scientific Session

As in previous years, the general scientific session was stimulating and indicated the wide range of interests of the various members of the Congress. Sixty-two papers were read and ten papers were presented by title only. There were a number of excellent papers on electromyography, some indicating its clinical applications and limitations and others emphasizing its role in research in neuromuscular diseases; there were also papers on other electrodiagnostic tests as well as on the effects of electrical stimulation upon denervation atrophy in experimental animals. An unusually large number of papers were devoted to problems encountered in the treatment of patients with neurological diseases and disabilities. A great deal of interest was shown in a symposium on ultrasound. Several papers were presented reviewing clinical evaluations of ultrasound therapy, and there were others on basic investigative work. Discussion following the papers was lively and interesting and definitely indicated that the final status of knowledge of ultrasound therapy has not been attained.

Special Lectures

The presidential address of Dr. Walter Solomon, of Cleveland, Ohio, the retiring president, was devoted to a discussion of the significance and purpose of the American Congress of Physical Medicine and Rehabilitation. Dr. Solomon emphasized the importance of the annual session and the need for continuing efforts in obtaining a larger membership, greater attendance, and more active participation in the annual meeting as well as in the meetings of the local and regional organizations pertaining to this specialty. He pointed out the importance of the *Archives of Physical Medicine and Rehabilitation*, which is the official publication of the American Congress of Physical Medicine and Rehabilitation.

The third John Stanley Coulter Memorial Lecture was given by Dr. Otto Glasser, head of the department of biophysics at the Cleveland Clinic Foundation, who talked on the topic, "A Medical Physicist Looks at Physical Medicine".

Dr. Theodore G. Klumpp, the president of Winthrop-Stearns Company, was the speaker at the annual Congress dinner. In his talk, entitled "Work and Happiness", Dr. Klumpp emphasized the importance of continuing at work or employment of persons in the older age groups, so that those 65 years old and older will remain happy and feel that they are deserving of a place in modern society. He decried the inflexible chronological retirement rules, which he finds are a very poor and inadequate solution of what

should be a relatively simple problem. He stated that the elimination of "all workers over a certain age is an unfair penalty on age and experience". This stimulating talk appears as the leading article in the November, 1953, issue of the *Archives of Physical Medicine and Rehabilitation.*

Instruction Seminar

The instruction seminar arranged by the Committee on Education of the American Congress of Physical Medicine and Rehabilitation continued to be a popular part of the annual meeting. Basic science topics on the pathological physiology of the spinal cord, physiological principles of artificial respiration, and the physiological basis for neuromuscular function were among those presented by specialists from all over the country. Particular interest was shown in the different viewpoints expressed regarding methods of neuromuscular re-education. Dr. Herman Kabat and Dr. O. L. Huddleston emphasized the importance of mass movement and facilitation technique, while Dr. G. C. Knowlton and Dr. Robert Bennett emphasized the importance of careful retraining of the paralysed or weakened neuromuscular units. A review of the anatomy of the cervical portion of the spinal cord and brachial plexus; complications relative to the use of hormones in the treatment of rheumatism; classification, diagnosis, and treatment of myelopathies; electromyography, basic physiology of the motor unit and its electrical activity and responses, and various clinical techniques were among other topics presented in the instruction seminar.

Awards

At the annual banquet the Committee on Gold Key Awards announced the names and achievements of two recipients for the year 1953, who have notably advanced the science and art of physical medicine and rehabilitation. One award was made to Dr. George G. Deaver, Professor of Physical Medicine and Rehabilitation at New York University, who established training courses in rehabilitation at the Institute for Crippled Children; trained the bulk of the early medical workers for the Air Force Reconditioning Services; was one of the pioneer workers and supporters of such groups as the Association for Aid of Crippled Children, the National Society for Crippled Children and Adults, the Academy of Cerebral Palsy, and the National Foundation for Infantile Paralysis, Inc. The other recipient of the Gold Key Award was Dr. Henry H. Kessler, of West Orange, New Jersey, internationally renowned surgeon and author, head of the Kessler Institute for Rehabilitation and President of the International Society for Welfare of the Crippled, who was one of the first surgeons to appreciate and recommend supportive physical medicine with reconstructive surgery, and is the originator of many ingenious operations and pros-

thetic devices for correction of or substitution for physical losses due to injury or hereditary absence of limbs.

Scientific Exhibits

The scientific exhibits were evaluated by a committee and the following awards made to those having outstanding exhibits: (1) Gold medal to Drs. Charles J. Imig, Wayne Sutfin, and Harry M. Hines, of the University of Iowa, for the exhibit entitled, "Plethysmography as a Method for Measuring Blood Flow." (2) Silver medal to Drs. A. A. Rodriquez and Joseph Koczur, for their exhibit on Physical Medicine and Rehabilitation at the Chicago Welfare Department Convalescent Home. This exhibit displayed in detail a unique municipal welfare service in total rehabilitation and showed practical gains and results achieved by this service in Chicago. (3) Bronze medal to Dr. Otto Eisert and Mr. Owen Tester for an exhibit on "Dynamic Exercises for Lower Extremity Amputees." (4) Honourable Mention to Mr. Howard A. Carter and Drs. Ralph E. De Forest and Frederic T. Jung for an exhibit on "Physics in Medicine". Other interesting scientific exhibits included one on the rehabilitation of the arthrotomized knee, one on a comprehensive survey of the ideas and work of the Committee on Balneology pertaining to health resorts in the United States, another on problems in rehabilitation of patients with chronic rheumatoid arthritis, and an exhibit of a teaching device for demonstrating the anatomy and motor function of the lumbo-sacral plexus. The Annual Awards Committee reported that no award would be made in the annual essay contest for 1953, but that this contest would continue next year. It is anticipated that an award can be made at the 1954 business session of the Congress.

Business Sessions

At the two business sessions a majority of the many committees of the Congress reported progress and increased interest in their activities. Several new committees are being formed during this year, and the duties of some of the other committees will be modified in order to keep pace with changing trends and new problems that are of interest to the members of the Congress. About fifty new members were presented by the Membership Committee and approved as members of the Congress. Dr. William B. Snow, of New York City, became President and Dr. William D. Paul, of Iowa City, President-elect. Reports were made by the regional officers of the Sections of the American Congress of Physical Medicine and Rehabilitation, and consideration was given to rearranging the geographical areas in some of the sections in order to make the regional meetings more accessible to a larger number of interested persons.

The 1954 session of the Congress will be held in Washington, D.C., from September 6 to 11.

CLINICAL REPORTS

HYPERTROPHIC OSTEOARTHROPATHY PRESENTING AS POLYARTHRITIS

CLUBBING of the fingers is not infrequently associated with diseases of the chest, and a polyarthritis due to hypertrophic osteoarthropathy may precede signs and symptoms of lung disease. The following case reports are those of two patients referred to the Department of Physical Medicine during the last twelve months for treatment of their arthritis.

Case Reports

CASE 1.—Mr. E. P., aged 70, a retired labourer, complained of pain in the ankles, knees, elbows, wrists, and interphalangeal joints of the hands for one month. He had lost one stone in weight in six months. He was noticeably dyspnoeic, and on questioning stated that he had recently become breathless on exercise and had noticed a pain under the right costal margin on taking a deep breath. He had smoked forty cigarettes a day for many years.

Examination showed him to be wasted and anaemic; bilateral clubbing of fingers and toes was present with palpable thickening of the radius and ulna on both sides; the affected joints were not swollen or warm, though movement was limited by pain; the right lower chest was dull to percussion posteriorly and there was grossly diminished air entry. X-ray examination of the hands (Plate XII, A) confirmed the presence of hypertrophic osteoarthropathy, and chest radiographs (Plate XII, B) showed collapse and consolidation of the right lower lobe. A diagnosis of bronchogenic carcinoma was confirmed by bronchoscopy, but the patient was not considered fit for operation or radiotherapy.

CASE 2.—Mr. S. M., aged 39, a Polish-born lapidist at present engaged in the grinding of gramophone needles, had been known to have painless clubbing of the fingers since the age of 15. When first seen in the Department of Physical Medicine he complained of pain in the hands, shoulders, and knees for twelve months and pain in the ankles for three months; the pain was continuous, but tended to vary in intensity from day to day and to flit from joint to joint; it was aggravated by cold and by rest, his joints being very stiff and painful in the morning, and relieved by movement. He had also had indigestion for six years, and in 1951 was operated on at another hospital for a perforated duodenal ulcer. He had no cough and was not breathless on exertion. He had lost one stone in weight in the past year.

On examination he looked healthy and was not anaemic. There was gross clubbing of the fingers and toes (Plate XIII, A), but no palpable thickening of the bones of the forearm. The interphalangeal joints of the hand were painful, stiff, and tender, but not swollen; movement of the wrists and shoulders was limited by pain; the ankles were warm and swollen and movement was very limited. The patient was emphysematous and a few rales were heard at the lung bases. He was admitted to hospital for further investigation and treatment.

Radiographs of the tibia and fibula showed subperiosteal new bone, and radiographs of the hands (Plate XIII, B) some tufting of the terminal phalanges. Radiographs of the chest, including bronchograms, were normal. Lung function tests, however, appeared to confirm the diagnosis of generalized fibrosis of the lungs. A large duodenal ulcer was discovered on barium-meal examination. Apart from a persistently raised erythrocyte sedimentation rate (20 mm. in one hour, Westergren) the results of laboratory investigations were normal. Physiotherapy and radiotherapy to the affected joints did not relieve his symptoms. Phenylbutazone, while relieving his pain, had aggravated his indigestion, and cortisone was also considered to be contraindicated because of the duodenal ulcer.

Discussion

Symmetrical bilateral clubbing of the fingers and toes may be congenital or acquired. When acquired it is usually associated with disease in the chest or less commonly in the intestinal tract. Hypertrophic osteoarthropathy is thought to be a later stage of the same process, and is characterized by clubbing of the digits, enlargement of the extremities, arthritis, and rarely thickening of the skin which may in a few patients be so marked, especially on the face, that the leonine facies is readily mistaken for acromegaly (Fried, 1943). Hypertrophic osteoarthropathy is much rarer than simple clubbing; it may complicate bronchiectasis, lung abscess, empyema, emphysema, and pulmonary fibrosis, and benign or malignant neoplasms of the lungs or pleura. A few cases have been reported in which no underlying disease had been discovered despite prolonged observation (Camp and Scanlan, 1948). The condition is well reviewed by Mendlowitz (1942). Although clubbing of the digits was first described by Hippocrates in patients with empyema, and hypertrophic osteoarthropathy was distinguished from acromegaly by Marie in 1890, their aetiology remains unknown.

Gall, Bennett, and Bauer (1951) give a good description of the pathological findings. There is hypertrophy of the soft tissues of the finger-tips, especially the nail bed; the periosteum is infiltrated with round cells and is extremely vascular, and the subperiosteal new bone is deposited in lamellae which may become fused with each other and the underlying cortex. These changes may be found in all the bones of the limbs except the carpals, tarsals, and terminal phalanges. Sterile effusions occur in the peripheral joints, with thickening of the capsule and synovia, perivascular collections of lymphocytes, and rarely pannus formation; secondary degeneration of cartilage occurs.

Radiological examination shows subperiosteal new bone, maximal in the region of the distal epiphyses and at musculo-tendinous insertions, but eventually ensheathing the whole shaft. Periostitis due to trauma, varicose veins, lymphangitis, and infections such as syphilis must be carefully dis-

[M. face p. 58]

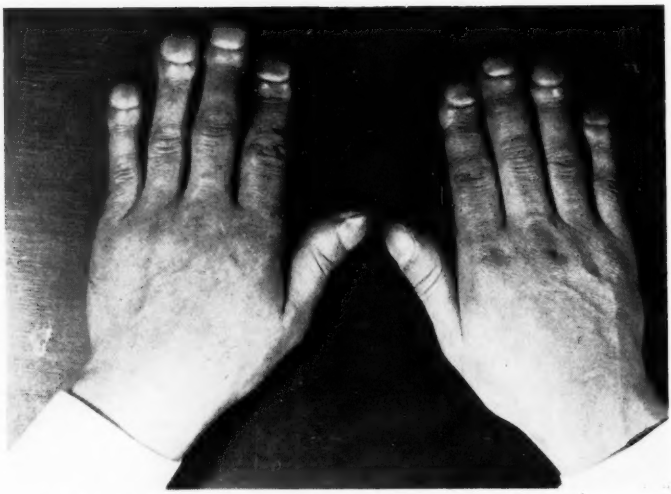
B

A

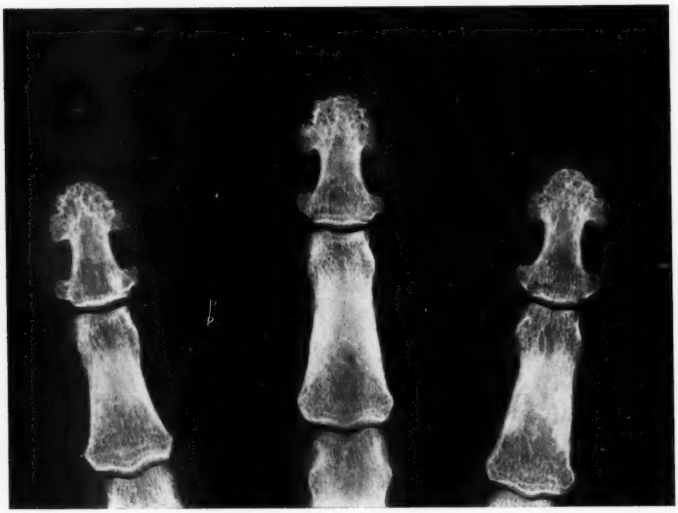
A.—Case 1. Radiograph of left hand to show subperiosteal new bone formation (marked by arrows).

B.—Case 1. Radiograph of chest showing collapse and consolidation of the right lower lobe.

[M. face p. 58]



A.—Case 2. Photograph of hands showing marked clubbing of fingers.



B.—Case 2. Radiograph of right hand showing soft-tissue swelling at fingertips and tufting of terminal phalanx.

tinguished. The tufts of the terminal phalanges may be hypertrophied, but atrophy and resorption of bone may occur in long-standing cases (Weens and Brown, 1945).

Hypertrophic osteoarthropathy, like simple clubbing, may be symptomless, but when arthritis is present it is often crippling and very resistant to treatment. Camp and Scanlan (1948) report one case in which the arthritis persisted without remission for over twenty years. Surgical removal of bronchogenic carcinoma, however, not infrequently results in relief of symptoms and disappearance of clubbing (Craig, 1937; Holmes, Bauman, and Ragan, 1950; Pattison, Beck, and Miller, 1951). Radiotherapy for lung cancer unfortunately appears to be ineffective.

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S. MATTINGLY

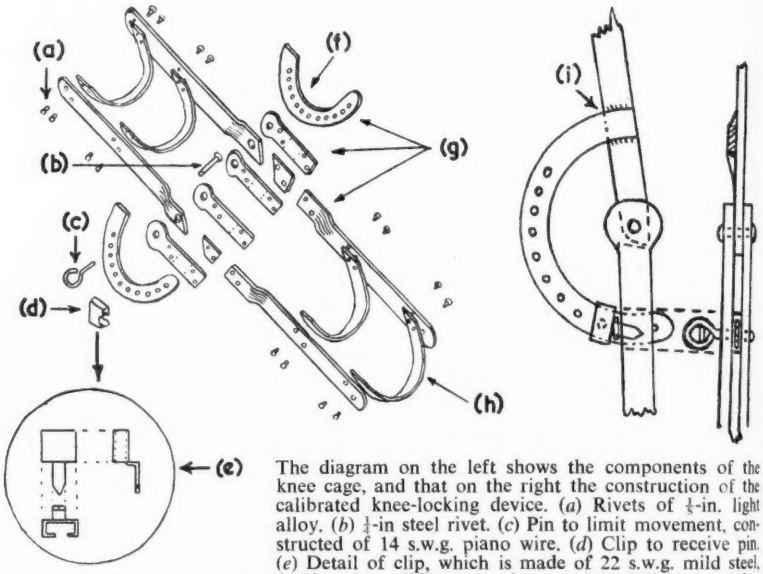
Department of Physical Medicine,
University College Hospital.

On February 24 at the Congress on Industrial Health in Louisville, Kentucky, Admiral Ross T. McIntire conferred upon Dr. Frank H. Krusen, an honorary member of the British Association of Physical Medicine, the National Presidential Award for services to the handicapped for the year 1953. The award is in the form of a plaque signed by President Eisenhower and is given to the physician considered to have made the greatest national contribution in the field of rehabilitation and employment of handicapped persons.

NEW APPLIANCES

AN ADJUSTABLE KNEE CAGE

THE knee cage illustrated in Plate XIV was devised for a patient who had had bilateral osteomyelitis of the femoral condyles eleven months previously. There was residual stiffness of the knee-joints due to chronic hypertrophic synovitis, and each attempt at mobilization resulted in reactionary effusions. The prevention of flexion beyond the safe limit during normal use and exercise by means of the locking device prevented these effusions occurring. The range of permitted flexion was then gradually increased as rehabilitation proceeded.



The diagram on the left shows the components of the knee cage, and that on the right the construction of the calibrated knee-locking device. (*a*) Rivets of $\frac{1}{4}$-in. light alloy. (*b*) $\frac{1}{4}$-in steel rivet. (*c*) Pin to limit movement, constructed of 14 s.w.g. piano wire. (*d*) Clip to receive pin. (*e*) Detail of clip, which is made of 22 s.w.g. mild steel, fashioned to slide on quadrant and to "click" into ring on pin. (*f*) Quadrant drilled at 10° intervals. (*g*) Quadrants, side-irons, and knee-lock components of 10 s.w.g. mild steel, moving and bearing surfaces case-hardened. (*h*) Stiffening hoops made of 16 s.w.g. "duralumin". (*i*) Quadrant welded to upper side-iron.

As recurrent effusions are not uncommon in patients with limited flexion due to a wide range of causes, it was felt that this appliance might be more generally applicable.

The knee cage, details of the construction of which are shown in the

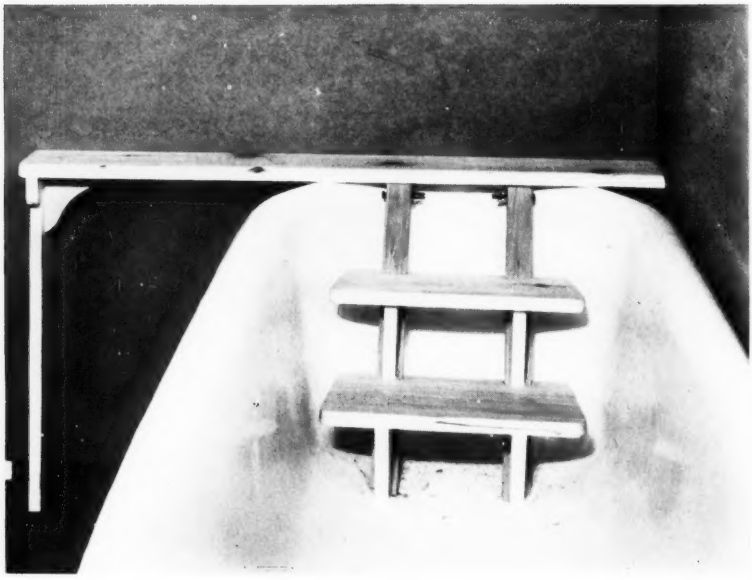
PLATE XIV

The knee cage applied.

The adjustable knee cage.

For details of construction see diagram opposite.

PLATE XV



Bath aid in position.

diagram overleaf, was designed and made in the Rehabilitation Workshops, Royal Air Force, Collaton Cross.

Acknowledgments

It is a pleasure to record my thanks to Group Captain Crooks and Wing Commander Keir for their interest, help, and encouragement.

I am indebted to the Director-General of Medical Services, Royal Air Force, for permission to publish this description.

P. J. R. NICHOLS
Royal Air Force

BATH AID FOR THE DISABLED

AN appliance made of wood has been designed to assist disabled patients to get into and out of a bath. This consists of a bench-type seat one end of which is supported by a leg the same height as the bath and to the other end are attached two steps. The structure is placed across the round end of the bath with the steps in the bath as shown in Plate XV. To enter, the patient sits on the part of the seat outside the bath, lifts his legs over the edge, and then slides along the seat and descends into the water step by step in a sitting position. He leaves the bath by the reverse procedure.

Wood for this appliance, which can easily be constructed in the department, costs approximately 10s.

W. RUSSELL GRANT

Winchester and Salisbury Hospital Groups.

ABSTRACTS OF THE LITERATURE

Mechanics of the Foot. The Plantar Aponeurosis and the Arch. J. H. HICKS. *J. Anat., Lond.*, 1954, **88,** 25.

The author has observed in the paralysed or dead foot that passive extension of the great toe produces a tight band in the sole and causes the arch to rise. Dissections were made to determine the nature of this tight band and its action. It was demonstrated that the band is the plantar aponeurosis and that it is carried forward beyond the head of the metatarsal and over the sesamoid and is attached to the base of the proximal phalanx. The attachment is strong enough to carry one-third to one-half of the body weight. Passive extension of the toe exerts a strong pull on the fascia "with a windlass effect" around the head of the metatarsal, thus causing the head of the metatarsal and the calcaneus to approximate slightly and the arch of the foot to rise. This occurs in standing on the toes and in walking, while in ordinary standing the reverse occurs, forcing the toes on to the ground. This phenomenon is most marked in the great toe, but occurs to a lesser extent in the others. The author considers that this effect is quite independent of muscular action.

A. C. ELKIN

Sjögren's Syndrome. A General Disease. A. D. MORGAN and R. W. RAVEN. *Brit. J. Surg.*, 1952, **40,** 154.

The object of this paper is to draw attention to the non-ocular aspects of Sjögren's syndrome, one of which is a polyarthritis often labelled rheumatoid arthritis. Two cases are described, both in women at the menopause who presented themselves with chronic arthritis of rheumatoid type, dryness of the mouth, gingival ulcers, bilateral parotid swelling, cutaneous circulatory disturbance, and raised erythrocyte sedimentation rate.

The diagnostic difficulties are discussed. The authors feel that this rare condition should be suspected in cases of keratitis sicca with chronic arthritis occurring in menopausal women. The polyarthritis usually precedes the eye symptoms and is severe.

From a review of over 50 cases it is concluded that no single cause for this syndrome can be discovered. In addition to the routine ocular treatment and symptomatic treatment of the arthritis, hormone therapy is recommended.

R. J. TALBOT

Genetic Aspects of Multiple Sclerosis. R. MULLER. *Arch. Neurol. Psychiat., Chicago,* 1953, **70,** 733.

A series of 810 patients with disseminated sclerosis has been analysed genetically. The incidence of disease in parents was $0{\cdot}3 \pm 0{\cdot}15\%$, in siblings $1{\cdot}0 \pm 0{\cdot}21\%$, and in the children $2{\cdot}3 \pm 1{\cdot}15\%$. The incidence of the disease in all observed relatives over the age of 9 years was $0{\cdot}6 \pm 0{\cdot}11\%$. Only 27 patients (3·3%) had some close relative affected with disseminated sclerosis.

The author finds no evidence in these findings to support the existence of a genetic factor in the pathogenesis of this complaint.

N. R. W. SIMPSON

Abstracts of the Literature

Incidence of Reflex Sympathetic Dystrophy of the Upper Extremity. V. A. I. LAINE. *Ann. rheum. Dis.*, 1953, **12,** 315.

Reflex dystrophy (shoulder–hand syndrome) occurred in 23 out of 125 painful shoulders—a percentage of 18·4. The sex and age incidence were similar to those of the rest of the group. In 4 cases the condition was associated with cardiac complications, in 13 with cervical osteoarthritis, and in 3 with trauma.

G. D. KERSLEY

Control of Heart Action by Repetitive Electrical Stimuli. C. E. HERROD, R. H. LEE, W. H. COGGANS, R. K. MCCOMBS, and F. GERBODE. *Ann. Surg.*, 1952, **136,** 510.

The authors describe an electronic device capable of delivering to the heart defibrillating shocks or repetitive electrical stimuli for pacemaking. It consists of a 2D21 Thyratron which is manually activated to provide an impulse continuously variable from 0 to 3 amperes and variable in duration from 0·01 to 1·0 second. At will the defibrillating portion of the circuit may be electronically activated at rates continuously variable from 20 to 130 per minute by an 884 Thyratron serving as a saw-tooth oscillator. Since the resistance of the heart has been shown to be approximately 50 ohms, a resistor of that magnitude was placed across the output terminals to act as a dummy heart and allow calibration of the output current.

Experiments on dogs showed that repetitive stimuli are capable of superimposing contraction upon the normally beating heart, and of dominating the rhythm if the conductivity is altered by procainamide. Repetitive stimuli will not revive the heart in a state of standstill due to anoxia, but will sustain blood pressure and rate in standstill due to vagal stimulation. Shocks of 1·5 amperes are most efficient in defibrillating a heart in ventricular fibrillation, but repetitive electrical stimuli of low voltage are of no value in restoring the heart in this condition or in the standstill that occurs after defibrillation with electric shocks. Rhythmic manual compression is more effective than repetitive electrical stimuli in reviving the heart in standstill.

O. F. VON WERSSOWETZ

The Effect of Electrical Stimulation on Muscular Atrophy Resulting from Acute Inanition. A. BRODISH, J. D. THOMSON, and H. M. HINES. *Amer. J. phys. Med.*, 1952, **31,** 153.

This paper records a study of the effect of electrotherapy on the loss of weight and strength and the creatine occurring in muscles during acute starvation and their restoration during re-feeding. The study was carried out on the gastrocnemius–soleus muscles of adult rats.

A loss of 30% body weight was the criterion for acute inanition, and electrotherapy consisted of supramaximal induction shocks of 60 per second for one minute daily to the fully stretched muscle. Comparisons of isometric tension, creatine content, and dry weight were made against non-stimulated contralateral muscles in the same animal and against a control group of animals.

This form of electrical stimulation retarded loss of weight and strength and creatine loss during starvation, and caused a slight increase in weight only during re-feeding. [Detailed results are not given.]

Some possible mechanisms are discussed.

P. J. R. NICHOLS

Abstracts of the Literature

Experimental Immersion Foot. A Review of the Physiopathology. H. MONTGOMERY. *Physiol. Rev.*, 1954. **34,** 127.

This paper from the University of Pennsylvania and the U.S. Office of Naval Research contains a comprehensive survey of the literature on the damage done to tissues by chilling—that is, cooling the limbs to temperatures not below 0° C.—though the 65 references given are mainly from the English-speaking world. The alterations found in blood flow, oxygen tension and utilization, and neuromuscular function are reviewed; the latter are of considerable interest. It is suggested that nerve trunks are highly vulnerable to cold, but that mild degrees of damage are rapidly reversible. The temperature changes in skin and muscle are correlated with alterations in circulation.

The conclusion is reached that it is not known whether the tissue damage which occurs is due to the direct effect of cold on the cell, or whether it is the effect of circulatory failure giving rise to accumulation of toxic products or insufficient supply of essential substances.

[Although heating techniques are of major importance in physiotherapy, the effect of cooling has largely been ignored. This review is an excellent survey of the effects of local cooling and contains much information about vascular reflex mechanisms.] R. HARRIS

The Local Clearance of Radio-active Sodium from Muscle in Normal Subjects and those with Peripheral Vascular Disease. D. N. WALDER. *Clin. Sci.*, 1953, **12,** 153.

The author has attempted to devise a test of value in the clinical assessment of patients suffering from intermittent claudication, using the rate of local clearance of radioactive sodium (^{24}Na) as a measure of the effectiveness of muscle circulation. A solution containing ^{24}Na was injected into the gastrocnemius muscle and a Geiger–Müller gamma counter applied over the injection site, readings being taken at 30-second intervals. The percentage of activity was plotted on a logarithmic scale, the slope of the graph being taken as an indication of the rate at which ^{24}Na was carried away from the injection site. Both normal subjects and patients with intermittent claudication were studied; in some cases the effect of the intravenous administration of adrenaline was also investigated. Plethysmographic measurements were carried out in addition. In normal subjects it was found that exercise led to a marked increase in the rate of clearance which persisted until the moment of stopping the exercise and subsequently returned to normal. The rate of blood flow (determined by plethysmography) returned to resting values less rapidly. Patients with claudication, however, showed a different response: in some cases the increased clearance rate due to exercise was not maintained, and it might fall off to zero a few seconds before the patient complained of pain. It might then rise again while the patient continued to exercise or, where the pain was too severe to permit exercise, the concentration of ^{24}Na might actually increase in the injection area. In cases with a contralateral asymptomatic limb abnormal clearance rates were also observed after exercise.

It is suggested that these results can be interpreted as follows: the capillary bed opens up with exercise, but the damaged vessels are unable to maintain

a sufficient flow through the bed and hence the clearance of ^{24}Na falls. The rise in concentration which may occur when intense pain exists may be a result of venous reflux.

These studies are claimed to provide an objective method of assessing the adequacy of muscle circulation without placing reliance on subjective pain sensations, and the author suggests that the subject with incipient asymptomatic claudication may be recognized by this means. He also suggests that such a technique would be of value in assessing the benefit derived from various forms of therapy; and this applies, of course, to physical treatment as well as to drug or surgical therapy.

R. M. MASON

Sodium–Potassium Ratio of Human Skin as obtained by Reverse Iontophoresis. F. B. BENJAMIN, R. KEMPEN, A. G. MULDER, and A. C. IVY. *J. app. Physiol.*, 1954, **6,** 401.

The composition of the electrolytic content of intracellular fluid is uncertain. A preliminary study was made to ascertain if tissue electrolyte values may be determined by reverse cutaneous iontophoresis. The apparatus consisted of a direct-current source, a large anode covered by a pad soaked in lithium nitrate, and a cathode plate placed in an open cup containing lithium nitrate as the contact medium. A current of 4 mA was passed for five minutes, which should release 12·4 micro-equivalents. The electrolyte content of the cup was measured at the termination of the experiment by means of a Perkin and Elmer flame photometer. Estimations were made when no current was passed and also when the sweat glands were inhibited by atropine sulphate, and results compared. The effects of cutaneous blood flow changes, trauma, and local injections, and the influence of age and sex, were also studied.

It was found that the Na : K ratio was not significantly influenced by sex, cutaneous blood flow changes, or sweating, but that it increased with age. A rise in tissue fluid pressure increased the concentration and ratio of ions, and local injection of sodium chloride and potassium chloride modified the results accordingly. Similar results were obtained when the experiments were repeated over a period of three months.

It is suggested that to ascertain its clinical value this method should be applied to patients with disturbances of electrolyte balance and the results correlated with those of metabolic-rate and blood determinations.

J. B. MILLARD

Adolescent Kyphosis. T. B. DAMERON and W. H. GULLEDGE. *U.S. Armed Forces med. J.*, 1953, **4,** 871.

The authors examined 1,000 young men in the order in which they reported for duty to a recruit training centre. Of these, 83 were found to have a significant fixed dorsal kyphosis; 61 of them showed radiological evidence of adolescent kyphosis and 22 did not. These 22 subjects were used as controls in a further investigation of the other 61. The average number of vertebrae affected was 4·5 and the range T3 to T12, with T7 most frequently involved. No predisposing factor was found. The commonest symptom—mild intermittent low backache, present in 11·5% of cases—was just as common in the control group.

J. M. MILNE

Abstracts of the Literature

Idiopathic Scoliosis. J. I. P. JAMES, *J. Bone Jt Surg.*, 1954, **36-B,** 36.

This paper from the Royal National Orthopaedic Hospital and Institute of Orthopaedics, London, is based on a review of 241 mature and 67 immature cases of idiopathic scoliosis. The pattern, prognosis, and symptomatology of lumbar, thoraco-lumbar, thoracic, and combined thoracic and lumbar idiopathic scoliosis are described and compared.

According to the author, the evolution of idiopathic scoliosis is determined by the site of the primary curve and the age of onset. Thoracic primary curves, which involve rib rotation, are commonly severe and of early onset. If curve patterns and age of onset are considered, accurate prognosis is possible, and correction and fusion can be advised for prevention of deformity at an age when correction is relatively easy.

P. J. R. NICHOLS

Rehabilitation following Ruptured Intervertebral Disc Surgery. J. H. ALDES and F. KOERNER. *Arch. phys. Med.*, 1952, **33,** 721.

The authors outline a rehabilitation programme adopted at the Cedars of Lebanon Hospital, Los Angeles, California, for patients suffering from herniated lumbar disk lesions subjected to surgery. Preoperative physiotherapy is considered to reduce the convalescent period in many patients, emphasis being placed on building up atrophied muscles and preliminary instruction in static exercises for the immediate postoperative period. Within 72 hours of operation static exercises are given for the abdominal, gluteal, quadriceps, and hamstring muscles and breathing exercises are started. Electrical stimulation is given as an aid to muscle re-education. Static exercises for the erector spinae are begun on the eighth day and progressive resistance exercises then given to weak limb muscles. An elastic webbing support for the lumbar region and pelvis is worn when the patient begins to sit up and is retained for at least four weeks, during which period walking commences. Exercises for rotation of the spine and to increase flexion and extension are started during the same period.

The authors consider that the residual low back symptoms following laminectomy are primarily due to muscle weakness and atrophy rather than to the results of surgical interference with the disk and vertebrae. The new programme has been used for patients subjected to laminectomy with and without spinal fusion, and is claimed to produce more satisfactory end-results than traditional methods of prolonged immobilization. [Unfortunately no comparative figures are given.]

J. G. PARISH

Die Extensionbehandlung der Osteochondrosis Cervicalis. (Extension Treatment in Cervical Osteochondrosis.) F. KULMANN. *Med. Klin.*, 1954, **3,** 105.

It is claimed that the apparatus described, which was tried out at a hospital in the Essen district, has many advantages over traditional methods of head suspension. For home treatment the latter frequently require alterations to ceilings or walls, whereas the method employed by the author enables the apparatus to be worn in a sitting, standing, or lying position. Curved shoulder-bars support two pneumatic cylinders the tops of which reach well above head level. A pneumatic tube is attached to the lower end of each cylinder, and both

tubes are connected to a sphygmomanometer bulb fitted with the usual air-screw. The top ends of the cylinders are joined by a cross-bar from which is suspended the usual "spreader" and head-sling. Air pressure in the cylinders (which raises the cross-bar) can be increased by compressing the bulb, and reduced (very gradually) by means of the air-screw, the maximum stretch obtained being equivalent to a weight of 20 kg. Patients can use the apparatus without any sense of fear, as it is under their own control. To demonstrate its efficacy X-ray films taken before and during treatment are reproduced.

[A pressure gauge in the air circuit would offer obvious advantages.]

D. PREISKEL

Early Management of Patients with Spinal Cord Injury. D. A. COVALT, I. S. COOPER, T. I. HOEN, and H. A. RUSK. *J. Amer. med. Ass.*, 1953, **151,** 89.

In this paper is outlined the treatment of patients suffering from spinal-cord injury at the Paraplegic Unit of the Institute of Physical Medicine and Rehabilitation of the New York University–Bellevue Medical Center. Hyperextension of the spine is avoided and transportation and nursing are carried out with the spine in the neutral position. Pain is controlled by codeine and acetylsalicylic acid derivatives, opiates being avoided owing to the danger of addiction. Testosterone propionate, 50 mg. daily by intramuscular injection, has been found to decrease the incidence of tissue breakdown, weight loss, and decubitus ulcer formation. Routine laminectomy is performed in every early case of paraplegia due to injury of the thoracic or lumbar spine, for the following reasons: (1) neither neurological nor radiological examination provides definite evidence of complete anatomical transection of the cord or of the degree of neurological damage; (2) even if laminectomy is performed three months or longer after injury, a useful degree of neurological improvement as well as a lower incidence of pain and spasticity may result; (3) there is often a considerable psychological improvement following operation.

Patients are allowed to sit up in a spinal brace at the end of 7 to 10 days after operation. After 10 to 14 days the patient is taught to stand with the aid of a tilt board 24 inches wide and 4½ to 6 feet long according to the height of the individual patient. The board is strapped in front of the patient with fabric lacers below and above the knees at the level of the pelvis and across the thoracic cage. The rehabilitation programme is divided into periods of one hour for exercises to the upper extremities starting on the day of admission, one hour in learning to stand and later in crutch drill, two hours in the activities of daily living (eating, dressing, toilet, etc.), and the fifth hour in vocational testing and guidance. A pelvic band is no longer fitted to the long leg calliper for patients with lesions in the lumbar region.

J. G. PARISH

Recovery of Muscular Strength after Poliomyelitis. W. RITCHIE RUSSELL and M. FISCHER-WILLIAMS. *Lancet*, 1954, **1,** 330.

Measurements of muscle recovery following poliomyelitis are of little value unless made under uniform conditions in regard to treatment and observation. For the purpose of the present analysis 70 paralytic cases of poliomyelitis were observed. Strength of recovering muscles was estimated by measuring their

maximum strength against spring balances excluding the effects of gravity. In addition strength and tendency to fatigue were measured by a recording dynamometer.

Results appear to indicate that some muscles may show as much as a fourfold increase in strength six months as compared with one month after onset. Other muscles do not, however, show the same increase, and the authors suggest that the optimum vigour of exercise and retraining varies with different muscles and different degrees of paresis. Recovery may depend, first on hypertrophy of the surviving muscular or neuronal elements, and secondly on a reorganization of the connexions of the surviving motor cells.

J. SHULMAN

The Use of Cortisone and Hydrocortisone (Compound F) in Treatment of the Painful Shoulder. M. B. COVENTRY. *Proc. Mayo Clin.*, 1954, **29,** 58.

The causes of pain in the shoulder are many and varied. The author distinguishes those characterized by a diffuse involvement ("periarthritis") and those due to lesions of a localized nature. He considers that "periarthritis" is not a primary condition, but is "instigated by pain, and enhanced by disuse in a patient with a dependent, passive, emotional pattern". He advises that in such subjects a trial of physical treatment—heat, exercises, and possibly massage—should first be given, and only if the patient fails to respond quickly to this should cortisone be added to the treatment. The hormone is given in doses of 75 mg. daily for 3 to 4 weeks. More than 50 patients have been treated by this regimen, and the results have been good. [No figures, however, are given.] It was found that the more acute the periarthritis the more favourable was the response.

According to the author, shoulder pain due to localized lesions is best treated by the injection of hydrocortisone, although a preliminary trial of physical treatment may first be given. A dose of 25 to 50 mg. is injected, and this is repeated a few days later if necessary. Immediate increase of pain is sometimes observed, but this is only temporary and, particularly in the acute conditions, the treatment may be dramatically effective; more chronic conditions respond more slowly, however.

This is a preliminary report. The author points out that caution is necessary in evaluating the effect of treatment in conditions, such as painful shoulder, which tend to improve spontaneously. His experience, however, is that good results are increased by the use of cortisone and hydrocortisone.

B. E. W. MACE

A Comparison of Cortisone and Codeine Medication as an Adjuvant to Manipulation in Rheumatoid Arthritis. A Report to the Joint Committee on Cortisone and A.C.T.H. in Chronic Rheumatic Diseases of the Medical Research Council and the Nuffield Foundation. *Brit. med. J.*, 1954, **1,** 233.

This investigation was carried out at four centres by a physician and an orthopaedic surgeon in each. The 33 patients selected were of all ages and had had a knee flexion contracture of at least six months' duration. None of them had severe disease activity or completely ankylosed knees. In 18 patients cortisone was given daily by mouth as follows: first day 200 mg.; second and third

days 300 mg.; fourth and fifth days 200 mg.; sixth, seventh, and eighth days 150 mg.; ninth and tenth days 100 mg.; eleventh to sixteenth day 50 mg. In the other 15 cases two tab. codein. co. were given three times a day for the same period.

The manipulation was performed on the afternoon of the second day. The surgeon was unaware whether patients belonged to the hormone-treated or the codeine-treated group. Following manipulation a plaster was applied for 24 hours, then bivalved for assessment and the posterior shell reapplied. After each assessment active assisted exercises were carried out under the supervision of a physiotherapist, and walking started as soon as possible. Cases remained as in-patients for 26 days and were followed up at two months (all but 6). In this investigation it was found that after the manipulation no significant difference occurred between the two groups with regard to pain, range of movement, function, swelling, and skin temperature over the affected joint (17 cases). In fact approximately two-thirds of the patients of each group required pethidine on the day of manipulation. There was little systemic disturbance attributable to the manipulation in either group, and a general exacerbation of the arthritis occurred in only one of the cortisone-treated series. The response of the contralateral knee as regards pain, tenderness, and function was similar in both groups. [No figures of the results of manipulation are given.]

ANDREW ZINOVIEFF

Chrysothérapie et Cortex Surrénalien. (Chrysotherapy and the Adrenal Cortex.) J. ROSKAM, H. VAN CAUWENBERGE, and M. VLIERS. *Rev. Rhum.*, 1953, **20**, 385.

The authors studied the urinary excretion of reducing steroids and of 17-ketosteroids in 6 patients (4 with rheumatoid arthritis and one each with ankylosing spondylitis and disseminated sclerosis) before and during gold therapy in an attempt to verify the suggestion that gold salts owe their beneficial action in rheumatoid arthritis largely to the production of an alarm reaction with the usual increase in endogenous ACTH (Selye, *Annual Report on Stress*, 1951). Reducing steroids were estimated by the method of Heard, Sobel, and Venning (*J. biol. Chem.*, 1946, **165**, 699), and 17-ketosteroids by that of Cohen and Salter (ibid., 1944, **152**, 489).

Results showed that during gold treatment there was a mean increase in the urinary excretion of reducing steroids of 1 mg. in the 24 hours, while in the case of the urinary excretion of 17-ketosteroids the increase in the 24 hours averaged 1·2 mg.

The authors conclude that there is hyperfunction of the adrenal cortex during gold treatment, and that the benefits of this therapy are, in part at least, due to this non-specific stimulation.

[Unfortunately the estimations cover too short a period of time to allow for the natural fluctuations in these diseases, thus rendering the results inconclusive.]

J. F. BUCHAN

Ureteral Electromygraphy in Congenital Megaloureter. R. BAKER. *Amer. J. Dis. Child.*, 1954, **87**, 7.

The obscure condition of congenital megaloureter is found in infants and children; most of those affected die before the age of 20. In this disease extreme

ureteral dilatation and hydronephrosis are present without any demonstrable obstruction. The possibility of a faulty neuromuscular mechanism producing atony of the ureter must be considered. Swenson and his co-workers have shown a decrease in the number and size of parasympathetic ganglia in the bladder of patients with this disease.

To pursue the problem further an electromyographic investigation of a case of this kind has been carried out at the University of Chicago. The procedure was as follows: 2 to 4 cm. of each ureter was freed of peritoneum anteriorly and of its underlying muscle posteriorly. The ureter was elevated from the underlying muscle by a small glass rod and the needle electrode inserted into it while it was suspended. A neutral electrode was placed in the skin of the abdomen.

The normal ureter is electrically silent at rest, but produces action potentials with peristalsis. In the case of congenital megaloureter studied the peristaltic waves were of decreased rate, appearing at a rate of one a minute. The only other electromyographic abnormality was a decrease in amplitude considering the extreme degree of dilatation present, but this was thought to be due to fatigue of the musculature of the ureter and not to abnormal parasympathetic innervation.

BASIL KIERNANDER

Microwave Diathermy and the Healing of Experimentally Produced Fractures in Rabbits. E. D. HENDERSON, W. A. BENNETT, and J. F. HERRICK. *J. Bone Jt Surg.*, 1954, **36-A,** 64.

The authors describe an experiment to determine whether microwave diathermy applied locally to a fracture site without other treatment influences the rate or quality of healing. In 17 rabbits the ulna was fractured accurately and as a preliminary the dose of microwave diathermy needed to raise the temperature in the medullary cavity from the resting level of 34·4°–35·6° C. to 40° C. was determined. Details of the procedure and of the insertion of thermistors are given. Six rabbits were excluded from the experiment for various reasons. The fracture site and the control limb in each of the other animals were exposed to microwaves for 30 minutes eleven times a week. With the director (angle type reflector) at a distance of 2 inches from the site of fracture a current of 25 mA was used in the microwave generator operating at approximately 12 cm.

The rabbits were killed 17 days after the ulna was fractured. On section no gross difference in the callus formation or clinical union of the fracture was observed. Radiological examination showed no difference in the quality or rapidity of healing. Microscopically the sections were indistinguishable. None of the animals was spared long enough for true consolidation of the fracture to take place.

The authors comment that, although the dosage of microwave diathermy appeared adequate to raise the temperature at the fracture site to 40° C. without causing a rise in body temperature, and to cause local vasodilatation and an increase in blood flow, there is no evidence that the amount of heat applied affected the healing of the fracture.

EUAN DAWSON

BOOK REVIEWS

Respiratory Function—Management in Disease. Physical Medicine Series, Vol. II. By RICHARD D. TONKIN. Pp. 64. 3s. 6d. London: Actinic Press. 1953.

Dr. Tonkin is to be congratulated on producing a very readable and interesting little monograph. The chief object of the monograph, which is primarily written for the physiotherapist, is to outline the physiological principles underlying pulmonary function and to express in terms of disturbances of function the deviations from the normal due to disease. In this way a specific line of therapy, founded on a rational rather than an empirical basis, is deduced. The objectives of physiotherapy are clearly indicated, and the reader is encouraged to work out from a knowledge of the case an appropriate line of treatment. However, it is stated that "detailed accounts of methods . . . have deliberately been omitted as these are adequately dealt with in larger treatises on physical medicine, and in addition are taught in schools of physiotherapy". The emphasis is on function as influenced by disease rather than on the disease itself, and this should appeal to those other than physiotherapists whose work is concerned with the restoration of function.

With a few exceptions the arrangement of the subject-matter makes for clarity of presentation. Several diagrams have been included, that illustrating respiratory movement in relation to lung volume being most instructive. Some of the other figures, however, are not very helpful. Brevity has, on the whole, added to the value of the book, but the anatomical section is perhaps too elementary, and the mode of development of a scoliosis after thoracoplasty requires further explanation.

Most interesting are the author's views on disturbances of function; postoperative collapse, the role of the diaphragm in emphysema, and the recovery of bronchiectasis in the absence of infection are but a few of the points discussed which are not usually dealt with in textbooks of medicine or physiotherapy. The author is convinced of the great value of physiotherapy in the treatment of chest conditions, and it will be encouraging to physiotherapists to feel that they are an integral part of treatment and in many cases can offer the patient considerable relief when other measures fail.

This book is deserving of study by all concerned with the physical treatment of lung diseases.

G. SAVILL

Rehabilitation Centres in the United States. By HENRY REDKEY. Pp. 128. $1.00. Published and distributed by the National Society for Crippled Children and Adults, Chicago, Illinois.

This booklet is a compilation of information submitted to the First National Conference on Rehabilitation Centers by forty rehabilitation centres in the United States. The Conference, held in Indianapolis in December, 1952, was sponsored by the National Society for Crippled Children and Adults and by the United States Office of Vocational Rehabilitation, to the latter of which the

author is consultant. Evidently there was a great deal of spirited discussion on the basic needs and practices in rehabilitation centres by those best qualified to discuss them—the people who operate the centres.

There are ten chapters, in the first of which an attempt has been made to express an over-all view of the rehabilitation centre as it has developed to date in the United States. There is a brief account of the basic principles of rehabilitation as applied to centres—viz., concentration of services within the total rehabilitation process; specialization; integration of services; complete evaluation of the patient; comprehensiveness and flexibility of regimen. This chapter is excellent and contains many enlightened views. In Chapters 2 to 7 there is a brief account ("snapshots") of some forty centres, classified into various groups, such as teaching and research centres, residential community centres, insurance and vocational centres, and community out-patient centres; the details given being mainly of interest to American readers. Chapters 8, 9, and 10 give an account of the method of integration of services, personnel required, and the professional and community relationships in rehabilitation centres. These chapters contain much interesting material.

Though this booklet is devoted entirely to American centres, it should prove of interest to all practitioners engaged in rehabilitation. Teamwork as a fundamental in the rehabilitation process is stressed again and again.

J. F. DIGNAN

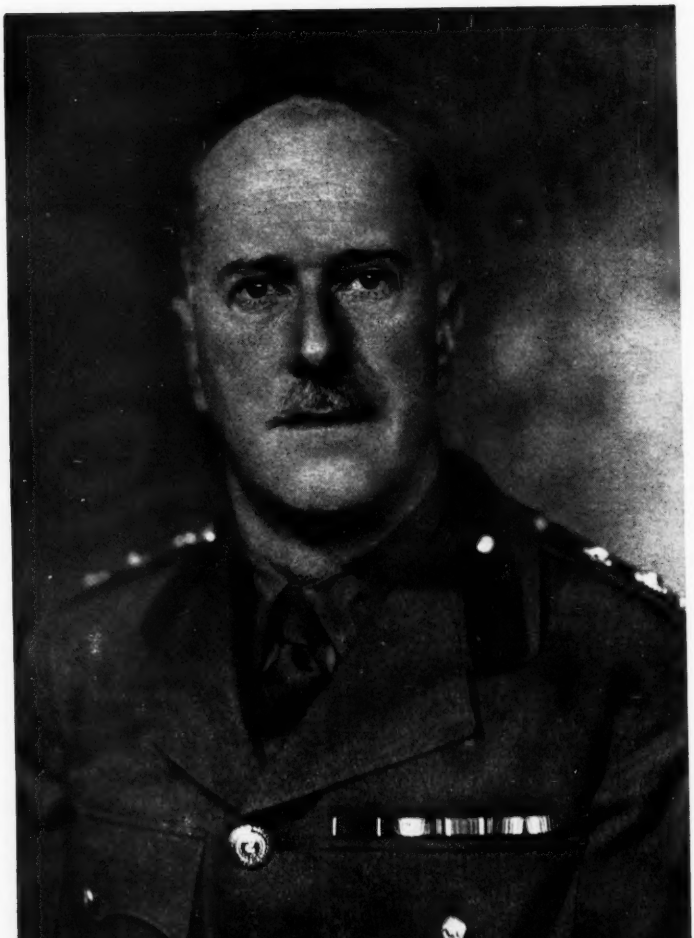
The Rehabilitation Centre. By G. GINGRAS, B.A.M.D., LEO DALLAIN, M.C., and M. MONGEAU, B.A., M.D. Pp. 24. $1.00. Published by the Rehabilitation Society for Cripples in Montreal, Canada. 1953.

This excellent booklet describes the layout of a rehabilitation centre which it was intended to establish in Montreal. The type of physical-treatment plant and procedures envisaged for setting up this centre are outlined. The authors visited and studied many rehabilitation centres in the United States, the United Kingdom, and Europe, and the plan they outline is the result of these visits. Actual rehabilitation techniques are not discussed.

The proposed mixed centre for adults and children, capable of accommodating 75 residents and 105 out-patients, consists of four floors, arranged in similar fashion to the functional plan for a rehabilitation service and centre proposed by the Baruch Committee in 1946. The details of the layout for each floor are illustrated in accompanying architect's plans; there is also a useful list of the medical and administrative personnel required. Dr. Howard Rusk has written a short foreword, and there is an excellent list of references.

The contents of this booklet should serve as a helpful guide to all who are interested in the establishment of such a centre.

J. F. DIGNAN



[*Lafayette*

THE LATE Dr. F. D. HOWITT